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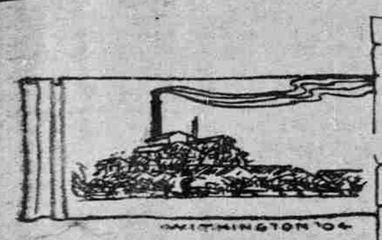


WITHINGTON '04

SOMETHING ABOUT THE SUGAR INDUSTRY IN THE HAWAIIAN ISLANDS

By C. F. ECKART in Governor Carter's annual report to the Secretary of the Interior.

The year 1876, when the reciprocity treaty between the Kingdom of Hawaii and the United States of America was entered into, marked the advance of the sugar industry of the Hawaiian Islands; labor was plentiful and comparatively cheap, and prices of sugar were high and the conditions favored a rapid increase in the sugar industry of the islands.

In late years, however, the prices of labor have risen and the prices of sugar have decreased, and periods of industrial depression have at times very much affected the sugar industry. The planters have had their prosperous years and have also suffered from lack of labor, droughts, low prices of sugar, and other conditions, during which times they have manufactured their sugar at such expense that there has been no profit. The unfavorable conditions, however, have been met with the progressive spirit of American farmers and business men, and improved methods of cultivation and manufacture have been adopted.

Twenty years ago the average yield of commercial sugar was about 10 pounds per 100 pounds of cane and the average yield of cane per acre was about 25 tons. At the present time the average yield of commercial sugar is about 12 pounds per 100 pounds of cane and the average yield of cane per acre is about 40 tons.

There are now being operated 52 sugar plantations, with outputs varying from 350 short tons of sugar per annum to 35,000. The great majority of these plantations are operated under their separate management, while a few sell their cane to neighboring mills and plantations. These 52 plantations are all represented in Honolulu by agents.

Most of the plantations are joint stock companies. There are a few, however, which are owned by individuals. Forty-three of the plantations which are incorporated have 6,366 stockholders.

The sugar is shipped to San Francisco, Cal., and around Cape Horn by steamer and sailing vessels. From California it goes overland to the East.

Under the United States navigation laws it is necessary that all sugar sent from here be shipped in American bottoms. The planters have been unable to obtain suitable American tonnage sufficient to carry all their sugar to the East around Cape Horn, and at least one-fourth of the crop of 400,000 tons produced last year had to go to San Francisco, Cal., and from thence overland at a rate very much greater than by all water.

The time taken in getting sugar to the market is from two to five months, owing to the great distance which it has to be transported.

In some instances the sugar is shipped direct from the port of a plantation, but in most cases it comes to Honolulu or Hilo, Island of Hawaii, or Kahului, and from there is shipped to the States. The shipment from the various island ports to Honolulu is accomplished through the two inter-island steam navigation companies, which control about nineteen vessels, representing an American tonnage of 6,018.

The island of Hawaii produces more sugar than any of the other islands, the island of Oahu coming next, followed by Maui and Kauai. The annual output of the islands since 1894 has been as follows:

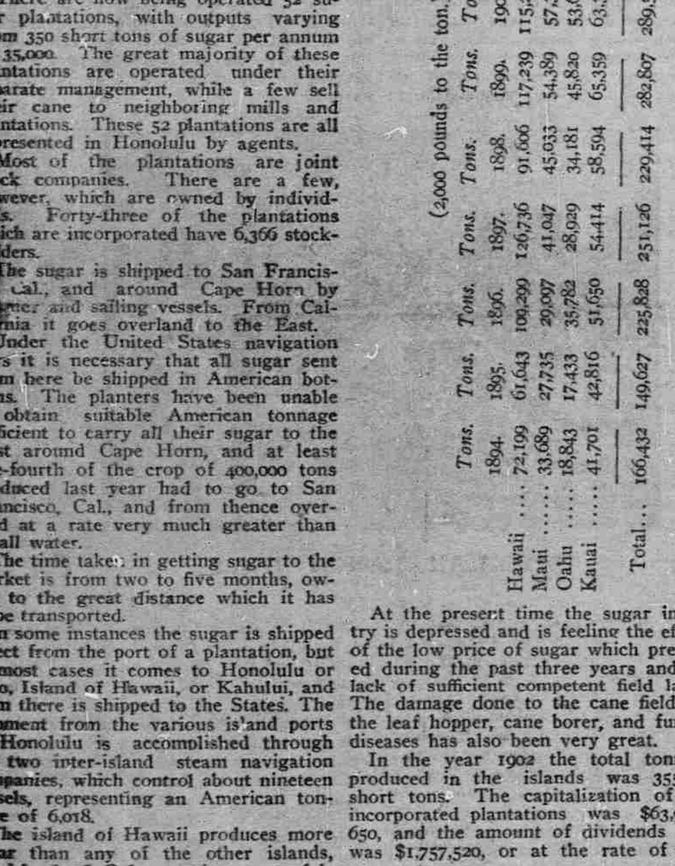
(2,000 pounds to the ton.)

	1894. Tons.	1895. Tons.	1896. Tons.	1897. Tons.	1898. Tons.	1899. Tons.	1900. Tons.	1901. Tons.	1902. Tons.	1903. Tons.
Hawaii	72,199	61,643	109,299	126,736	91,606	117,239	115,224	134,518	121,295	170,665
Maui	33,689	27,735	29,097	41,047	45,033	54,389	57,347	58,349	56,726	84,776
Oahu	18,843	17,433	35,782	28,929	34,181	45,820	53,625	99,534	107,870	121,066
Kauai	41,701	42,816	51,650	54,414	58,594	63,359	63,348	67,537	69,720	61,484
Total	166,432	149,627	225,828	251,126	229,414	282,807	289,544	360,938	355,611	437,991

At the present time the sugar industry is depressed and is feeling the effects of the low price of sugar which prevailed during the past three years and the lack of sufficient competent field labor. The damage done to the cane fields by the leaf hopper, cane borer, and fungus diseases has also been very great.

In the year 1902 the total tonnage produced in the islands was 355,611 short tons. The capitalization of the incorporated plantations was $63,940,650, and the amount of dividends paid was $1,757,520, or at the rate of 2.75 per cent.

In 1903 the total tonnage produced was 437,991 short tons. The capitalization of the plantations was $64,878,931.63, and the total amount of dividends paid was $1,555,652.68.



"HOW'S THIS FOR HIGH?"

YIELDS, FERTILIZATION, AND CULTIVATION.

The yield of sugar for the Hawaiian Islands for the crop of 1903 was 438,054 short tons, which quantity was harvested from an area of 93,350 acres. The following statements of yields show the relative production on irrigated and unirrigated plantations and for the islands as a whole.

Yields of Sugar for 1903.

Hawaiian Islands, 93,350 acres; total sugar, 438,054 tons; yield per acre, 9,385 pounds.

Irrigated plantations, 42,097 acres; total sugar, 260,525 tons; yield per acre, 12,377 pounds.

Unirrigated plantations, 51,235 acres; total sugar, 177,529 tons; yield per acre, 6,927 pounds.

While the average yield of 4.69 tons of sugar per acre appears high when compared with that of other sugar-growing countries, it is a measure misleading, for the fact that the Hawaiian cane crop takes as a rule from eighteen to twenty-two months to mature (thirty months are required on certain fields on the uplands of Hawaii) necessitates a considerable reduction in this stated yield before it can be brought into comparison with annual crops of other countries.

Reliable statistics have been recorded since 1895 showing the yields of sugar and acreage of all plantations in the group and the increased production per acre between 1895 and 1903 may be seen from the following figures:

Under cane, acres, 1895. 47,399.5; 1903, 93,350.

Total yield of sugar, tons, 1895, 157,419.5; 1903, 438,054.

Yield of sugar per acre, pounds, 1895, 6,472; 1903, 9,385.

This increased yield per acre during a period of nine years may be attributed to several causes, which may be briefly stated as follows:

The Expansion of the Sugar Industry Through the Taking Over of New Land.

A certain gain per acre has without doubt followed the planting of new lands. The total area of cane harvested in 1895 was 47,399.5 acres. Of these sugar lands 23,945 acres, or practically 50.6 per cent, were dependent upon rainfall for their water supply, and 23,454.5 acres, or 49.4 per cent, were irrigated. In 1903 the area of cane harvested was 93,350 acres, of which 51,253 acres, or 54.8 per cent, were dependent upon rainfall, and 42,097 acres, or 45.2 per cent, received irrigation. These figures show that the unirrigated area has increased over the irrigated lands by 9,156 acres since 1895. Unless we stop to consider the nature of the lands added to the sugar area in each instance we would expect to find a decrease in the acre yield for 1903 rather than an increase, other influences being omitted from consideration.

New lands taken over by the unirrigated plantations have been largely on the higher levels, where the soil is thinner and poorer as a rule, and the sugar yields, although at first good, are soon reduced after harvesting one or two crops and become less than those obtained from the lower-lying areas. On the irrigated plantations the new lands which have been added to the cultivated area have usually been richer than those under cultivation for some time, and such expansion has followed the opening of new sources of water supply with the advantages of improved irrigation facilities. The production per acre on the unirrigated plantations was 30.4 per cent higher in 1903 than in 1895, and on the irrigated plantations a gain of 61.3 per cent was obtained during the same period. The gain in the former instance must be attributed almost entirely to improved methods of cultivation and fertilization and to the introduction of more thrifty varieties of cane, while in the latter case a greater production due to new lands cannot be omitted as an important factor along with the gain from progressive methods of cane farming. A considerable part of this gain on the irrigated plantations was due to the yields of three plantations situated in a favorable locality bordering on Pearl Harbor. The acreage of cane harvested from these plantations in 1903 was 10,419 and the sugar yields 88,768 tons. Omitting these plantations from the list of irrigated estates would reduce the average yield per acre of irrigated plantations for 1903 from 12,377 pounds to 10,844 pounds, and of 423 pounds. Two of these plantations, representing 49,993 tons of the 1903 crop, came into existence later than 1895, and the other has largely extended its area since that year. Increased technical skill in the mill and sugarhouse, with a resulting decrease in losses of manufacture, has also added to the output per acre.

While the foregoing comparison shows a remarkable increase between the years 1895 and 1903, it must be borne in mind that the high-water mark in the production of these islands has been reached; the crop for 1904 will not reach more than 380,000 tons, while that of the following year is not estimated to amount even to that figure.

The profits accruing from the increased yields on the irrigated plantations have not always been commensurate with the increased production, owing to the large cost of waterway construction and of pumping. The cost of irrigation includes the installation of pumps, construction of ditches and reservoirs, tunneling, and the labor of applying water to the cane furrows. The expense incurred in the making of Hawaiian irrigation ditches may be conceived when the obstacles encountered in this line of engineering work are considered. The headworks of the Makaweli ditch, for instance, involve 29 tunnels of a continuous length of 5 miles, 7 feet wide and 7 feet high excavated in the solid rock and built on a grade of 8 feet per mile, which will give a daily capacity of over 60,000,000 gallons when running 4 feet deep (report of M. M. O'Shaughnessy). As regards the cost of pumping to higher elevation, Mr. O'Shaughnessy states: "To pump 10,000,000 gallons daily against a head of 300 feet with ordinary pumps and fuel in service will consume 15 tons of coal daily, which at $8 per ton amounts to $120 for daily fuel expenses." Another engineer computes the average cost of lifting 1,000,000 gallons of water 1 foot, with coal as fuel, to be as follows:

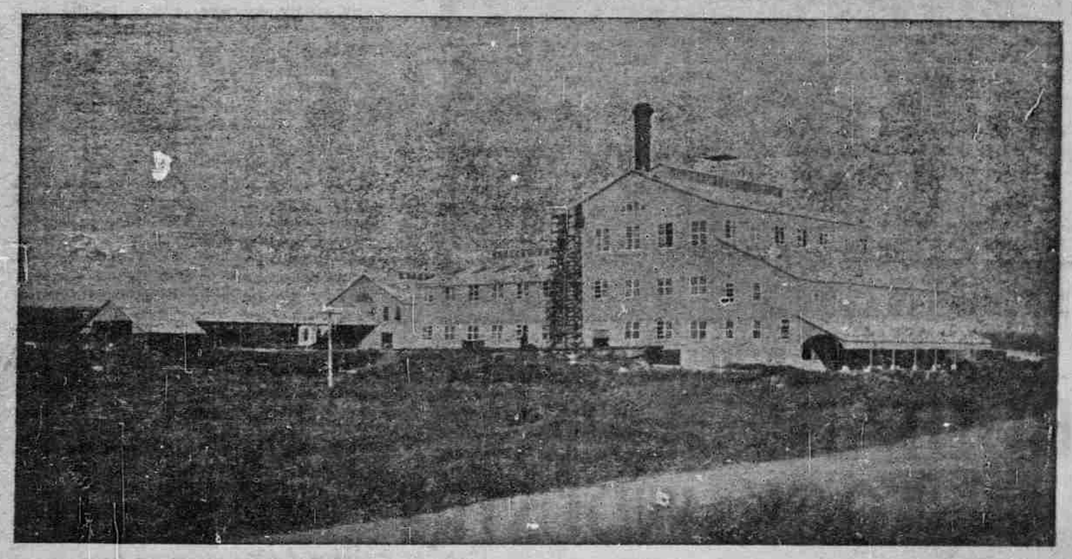
Operating expenses	$0.081
Interest 6 per cent	.014
Depreciation 3 per cent	.007
	.102

With fuel oil the average cost is reduced as follows:

Operating expenses	$0.053
Interest 6 per cent	.014
Depreciation 3 per cent	.007
	.074

About 5,000,000 gallons are used per acre in the growing of a crop and this quantity is pumped to a maximum height of 550 feet.

A careful test conducted at the experiment station of the Hawaiian Sugar Planters' Association in Honolulu showed that without irrigation it was only possible to obtain 1,600 pounds, or less than 1 short ton of sugar per acre. This was with a rainfall of 32.5 inches per year. The largest of the irrigated plantations have a much smaller rainfall than 32.5 inches, and it would not be possible to harvest even the small acre output indicated by the unirrigated cane at the experiment station. A yield of 1,600 pounds of sugar to the acre the islands as a whole from 9,385 to 8,would not justify the expense of growing, harvesting, and milling the same, and it is safe to say that were the sugar lands of this Territory entirely dependent upon rainfall, the 1903 crop would have yielded little more than 177,529 tons of sugar.



OLAA, A TYPICAL SUGAR MILL.

INTRODUCTION OF NEW VARIETIES.

In accordance with the experience of planters in other sugar-growing countries, those of Hawaii have been obliged to maintain the yields in many localities by the substitution of more thrifty and hardier canes than the old standard varieties. The attention given to this subject on many of the plantations has undoubtedly helped to raise the acre output. On Hawaii, the Lahaina came after having been grown for many years was finally succeeded by the Rose bamboo, which latter variety is now making way for a more vigorous cane, termed Yellow Caledonia. In districts subject to overcopious rains or to excessive drought, and where Lahaina and Rose bamboo (in less measure) would show an occasional falling off in production, under such adverse influences Yellow Caledonia, through its hardier characteristics, has maintained a favorable yield in less-favored seasons. On lands which had given out for Lahaina to such an extent that the cane made but a meager growth, this variety has yielded a profit to some plantations that would otherwise have taken off their crop at a loss.

The Hawaiian Sugar Planters' Association maintains at considerable expense an experiment station in Honolulu, where new varieties introduced from foreign sources are carefully tested as to their productive value, and then sent to the various plantations for trial under their conditions. With the advent of serious insect pests and fungus diseases in Hawaiian cane fields, it became necessary to carefully watch the growth of these canes to note their relative immunity from disease and their ability to cope with the serious pests of the islands.

FERTILIZATION AND CULTIVATION.

Probably in no other cane-growing country does the subject of fertilization receive so much consideration as in the Hawaiian Islands, and the study which has been given to this question by plantation managers has done much to raise the sugar yield per acre throughout the Territory. Planters here have adopted a policy different from that usually in vogue. They do not wait to fertilize after the soil is depleted and exhausted, but practice the plan of sustaining the food qualities of the land and bettering its condition by the extensive use of fertilizers on the virgin soil. The percentage of the various ingredients, as well as the forms in which they are applied in mixed fertilizers, are carefully considered with regard to climate and soil and, owing to the diversity of Hawaiian conditions, fertilizer formulas show wide variations in the various districts of the group.

The average quantity of mixed fertilizer applied per acre for the crop of 1903 was 910 pounds, the average formula being 7.1 per cent phosphoric acid, 10.1 per cent potash, and 6.1 per cent nitrogen. The amount of mixed fertilizer applied to the crop of 1903 was approximately 41,000 tons. The amount of nitrogen, phosphoric acid, and potash used was as follows:

	Tons.
Nitrogen in mixed fertilizer	2,501
Phosphoric acid in mixed fertilizer	2,911
Potash in mixed fertilizer	4,141

About 6,000 tons of nitrate of soda containing approximately 900 tons of nitrogen were also used. These large quantities of the various fertilizing ingredients would have values somewhat as follows:

Nitrogen in mixed fertilizer	$750,300
Phosphoric acid in mixed fertilizer	232,880
Potash in mixed fertilizer	393,395
	1,376,575
Nitrogen in nitrate of soda	270,000
Total	1,646,575

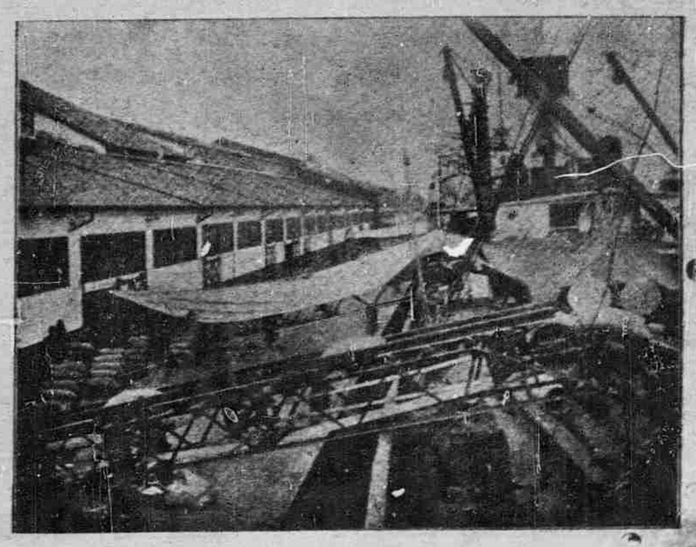
In addition to nitrate of soda, specially bought fertilizers, such as lime, ground coral, fish scrap, muriate of potash, tankage and a mixture of nitrate of soda and sulphate of ammonia were applied. The value of these latter materials, together with the cost of bagging, mixing of complete fertilizers, and transportation would bring the total amount expended for fertilizers to somewhat over $2,000,000. Besides these fertilizers, which were bought, large quantities of stable manure, furnace ash, molasses, and disintegrated mud press cakes were used, the exact quantity of which is not known.

On one plantation, as a result of careful fertilization, a gain of 100 per cent in sugar was obtained over unfertilized land. On very fertile soils, which respond less to fertilization, a gain of 20 per cent has been reached through the use of suitable fertilizing material.

Almost as much attention has been given to cultivation as to fertilization, and owing to the diversity of methods little can be said on the subject in a brief report of this nature. The most approved patterns of agricultural implements are used, and specially constructed plows, harrows, etc., have been adopted in some instances for the thorough preparation and cultivation of the soil. Steam plows are used on many estates, and deep plowing with moderate subsoiling are practiced where the depth of the staple will permit. In the rainy districts the cost of stripping, i. e., removing the dried leaves from the cane and keeping down weeds, are large items in the expense of cultivation.

During the last several years the cane fields of the Hawaiian Islands have been afflicted with a serious pest, termed the leaf hopper (Perkinsiella saccharicida), which on many estates has greatly reduced the yield of the 1904 crop. Since getting a foothold in the Territory it has been noticed on seed cane arriving from Queensland and on Chinese cane imported for eating purposes by the Chinese population. It very probably was received originally from either Queensland or China, where it is not known as a pest, owing to the presence of natural enemies which keep it in check, or limitations exerted on its reproductive capacity through climatic causes. An inspection of all plants entering the islands is now rigidly enforced, and much labor and expense have been incurred in reducing to a minimum the chances of receiving insect and fungous pests from foreign sources. The Hawaiian Sugar Planters' Association has organized an efficient entomological bureau for the control of various cane pests, and it is expected that much will be accomplished in keeping down to a safer limit the hopper, borer, and such pests as have in the past proved highly injurious.

The prevailing low prices of sugar and high cost of labor, together with the serious loss annually incurred from insect and fungous depredations necessitate the utmost vigilance on the part of plantation managers to determine sources of loss in the mill and fields, and through technical skill in the one instance and progressive methods of farming in the other, to combat the tendency toward reduced profit which has been strongly felt from year to year.



LOADING SUGAR ON STEAMER.